**Staphylcocci**

* Family (Micrococcaceae, Gm-, produce catalase, facultative anaerobes, nonmotile, non-spore forming, when cultured → cluster

Coagulase positive Staph (CPS)

* Β-hemolytic
* **S. aureus**
  + “Golden grapes” due to production of carotenoids
  + Virulence Factors
    - Agr (accessory gene regulator)
    - PG – alternating NAG, p-NAM subunits | Target for β-lactams + glycopeptide antibiotics
    - Teichoic Acid – Phosphate-containing polymer | Makes up the major surface Ag
      * 2 Types: One type is linked to cell membrane
      * One type is linked with ribitol + Phosphorylated to cell wall
    - Protein A (Unique to S. aureus)
      * Binds to Fc terminus of IgG molecule
      * Immunological tool
  + Epidemiology
    - Begins at birth mainly in Anterior Nares
      * 1.5% get colonized with MRSA
    - Vaginal carriage – 10% | Hospital Personal – 50-90%
  + CA-MRSA (Community acquired MRSA)
    - Resistance to methicillin
    - Carry Ponton-Valentine Toxin (PVL) → severe necrotizing pneumonia with sepsis
    - Risk factor: Skin trauma | ↑ body mass index | sharing equipment | Body Shaving
  + Diagnosis
    - PFGE – Cuts DNA at rare restriction sites + uses electrophoresis at alternating angles to separate DNA
    - Test Coagulase with Tube coagulase (>2 hrs) or Staphaurex (2 min)
  + Pathophysiology
    - Adherence: Mucosal/Nasal Epithelial cells | Traumatized Skin | Endothelial Surfaces
    - Invasion: Invade via binding to thrombin, fibrin, or endothelial cells
      * Release proteolytic enzyme | Host Responses activated → Abscess Formation
    - Severity of disease depends on host immunity
    - Host defects in chemotaxis and DMN killing defects → predisposition for S. aureus inf.
  + Toxins
    - Catalase (H2O2 → H2O + ½ O2) – Differs from Staph
    - Coagulase (bind to prothrombin to induce fibrinogen → fibrin)
      * Activated clotting cascade + prevents phagocytosis by binding to organism
    - Hemolysins – Lyse RBC + other cell types
    - Leukocidin – Binds phagocytosis + creates membrane pores
    - Hyaluronidase – Hydrolyzes hyaluronic acid in CT
    - Fibrinolysin – Dissolves fibrin clots
    - β-lactamases – Antibiotic R
    - Exofoliations – Bind to desmosomes → SSSS
    - Cytotoxins – α, β, δ, γ
    - Superantigens – cause TSST (no bacteria or Ag required)
  + Clinical Manifestations
    - Staph food poisoning
      * Ingestion of preformed enterotoxin
      * Abrupt onset in 2-6 hrs | Self-limited
    - Pygenic disease
      * Folliculitis (zit) → Furuncles/Carbuncles → Hidradentitis supportive
      * Impetigo – Superificial infection of skin lesion → crusty
      * Cellulitis – Infection of dermis, subQ tissue
      * Lymphangitis – Dissemination of infection thru lymphatics
    - Toxic Shock Syndrome
      * Certain TSST-1 producing strains under certain conditions → produce toxin
      * Non-menstrual – 48 hours after surgical procedure
      * Menstrual – ages 15-25 with tampon usage
      * Abrupt onset of myalgia | fever | V/D | confusion
      * Severe hypotension | renal insuffiency | shock liver
      * Rash with desquamation of palms + soles within week
      * Comp: Long-term Neuro Sequelae possible
      * T: Remove Staph source + supportive measures
    - SSSS (Staph Scalded Skin Syndrome)
      * Generalized – Toxin is systematic
        + D – Nikolsky’s sign (detachment of skin upon rubbing)
      * Localized – Blistering around an infected area
      * T: Anti-staph agents | Local wound care
    - TEN (Toxic Epidermal Necrolysis)
      * Cleavage within dermis or dermoepidermal jxn | Similar to SSSS
      * An immune rxn to drugs that are used for infections
      * T: Steroids
    - Disseminated Infection (Staph that has spread via blood)
  + Treatment
    - Remove foreign object + drain pus
    - Antibiotics
      * If MSSA (methicillin-sensitive)
        + β-lactams
      * if HA-MRSA (altered PBP protein → penicillin R
        + Vancomycin
      * If CA-MRSA
        + Doxy | Trim-Sulfa | Linezolid | Vanco
        + Rifampin if in combo
      * If VISA/VRSA (vanco-R MRSA)
        + Linezolid | Sunerzid | Daptomycin

Coagulase negative Staph (CoNS)

* γ-hemolytic (no hemolysis of blood)
* **S. epidermis**
  + Normal flora of skin/mucous membrane
  + Typically obtained nosocomially (hospital)
  + ↑antibiotic resistance due to easy horizontal gene transference
    - >80% methicillin R | >50% R to others
  + T: Vanco, Rifampin, Cipro
  + Pathophysiology
    - Has an exopolysaccharide layer (biofilm)
      * Protects from opsonization and ↓ penetrance of antibiotics
      * → problems on “hardware” (ie. Lines, IV, shunts…)
  + Clinical Implications
    - DO NOT take Culture from Lines b/c of this bacteria
    - Intravenous Catheter Infection
      * → may lead to bacteremia
      * T: Remove + Vanco
    - Bacteremia
      * → “line sepsis” | sternal osteomyelitis after heart surgery | prosthetic joint infection
    - Endophthalmitis
      * Common after eye surgery and in IV drug abusers
      * T: vitrectomy + IV Vanco + intravitreal antibiotics
    - Infective Endocarditis
      * Native Valve (5%) | Prosthetic Valve (40%)
      * D: Multiple blood culture + clinical suspicion
      * T: Vanco + Genta + Rifampin + Removal/Replace Valve
    - UTI
      * Normal in catheterization of elderly hospital patients
* **S. hemolytics**
  + Normal on skin + mucous membranes
  + Catalase + | Coagulase - | γ-hemolytic on blood agar
  + Clinical Implications
    - Same as S. epidermis
* **S. saprophyticus**
  + Catalase + | Coagulase - | γ-hemolytic
  + True urinary pathogen
  + Clinical Implications
    - UTI
  + T: Quinolones, Bactrim
    - Novobiocin R
* **S. logdunesis**
  + Coagulase - | β-hemolytic
  + Clinical Implications
    - Very aggressive endocarditis
    - Bacteremia | UTI | Central Line Inf. | Wound Inf.| Arthritis
  + D: PYR – positive (most staph are negative)
  + D: Rapid ornithine decarboxylase – positive (most staph are negative)